

# GEOS-5 Update

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Global Modeling and Assimilation Office

EOS-Aura Meeting: Meteorological Products Working Group  
September 11, 2006

# Objectives

- Brief summary
- Some results
- Projected timeline

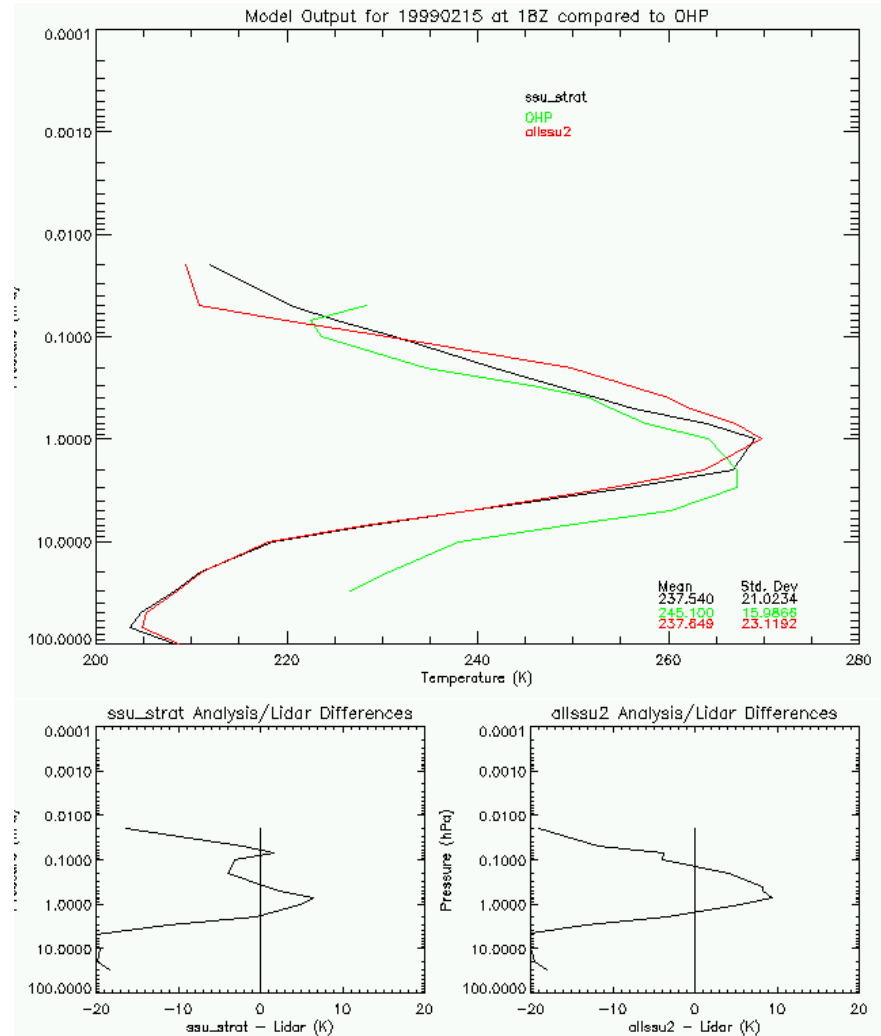
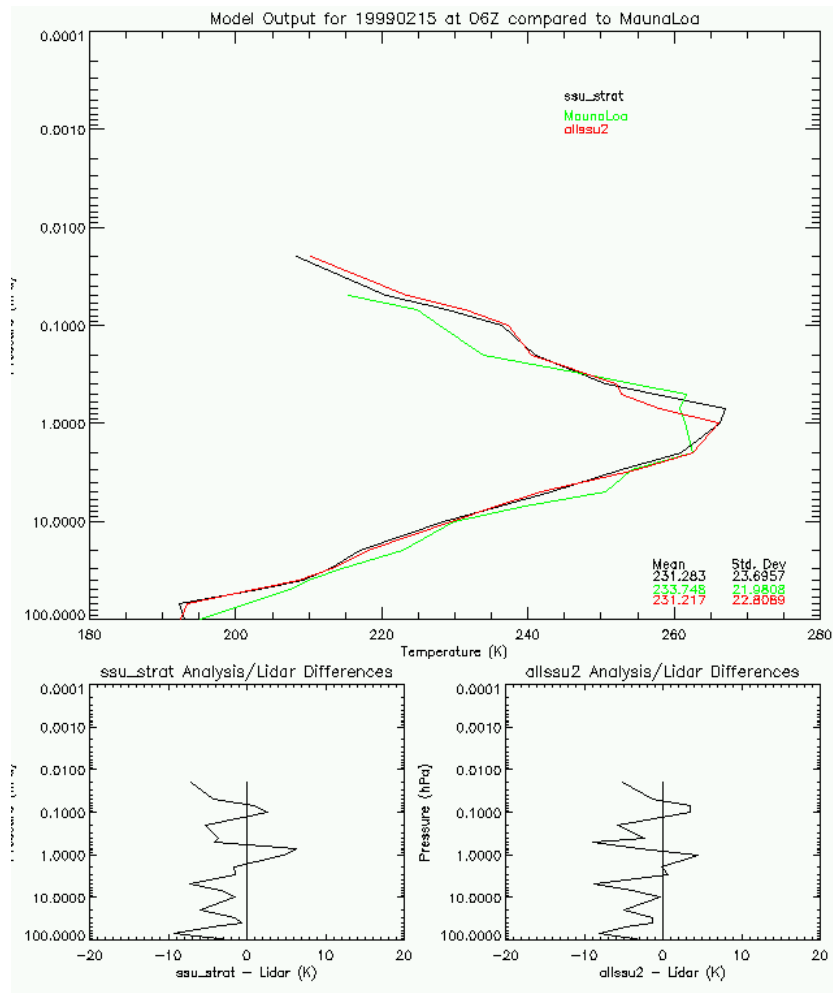
# GEOS-5: Salient Points

- GCM - best of GEOS-4, GEOS-3, more:
  - Finite-volume (Lin-Rood) dynamical core
  - Moist processes updated from GEOS-3
- Analysis - collaboration with NCEP:
  - 3D-Var (GSI)
  - Radiances from operational sensors
- Assimilation:
  - Incremental Analysis Increments (IAU)

Figure 1 displays vertical cross-sections of temperature (K) and differences (Top-Middle) for the 2006 and 2011 seasons. The plots are arranged in a 3x2 grid. The left column shows the 2006 season, and the right column shows the 2011 season. The top row shows the temperature (K) for the 2006 season (b901 JAN (1)) and the 2011 season (b901 JAN (1)). The middle row shows the temperature (K) for the 2006 season (NCEP OPNL\_data\_gdas1 JAN (Actual)) and the 2011 season (ECMWF OPERATIONAL ANALYSIS JAN (Actual)). The bottom row shows the difference (Top-Middle) for the 2006 season and the 2011 season. The y-axis for all plots is Pressure (mb) from 1000 to 30. The x-axis for all plots is Latitude from 90S to 90N. The color scale for temperature ranges from 190 K (dark blue) to 295 K (dark red). The color scale for differences ranges from -18 K (dark blue) to 8 K (dark red). The 2006 season shows a significant temperature difference (Top-Middle) in the stratosphere, particularly around 30S to 30N, while the 2011 season shows a much smaller difference.

# Zonal-mean Temperature for January 2006: comparing a half-degree resolution version of GEOS-5 with NCEP and ECMWF

# Comparison with Lidar T

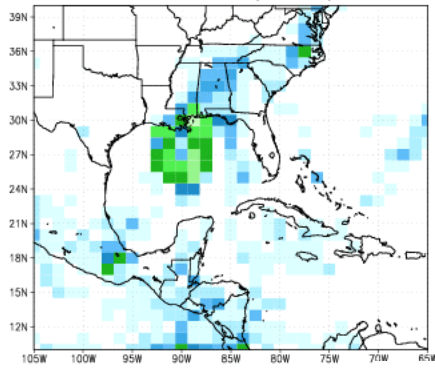


# GEOS5 & Katrina: MAP05 vs MAP06

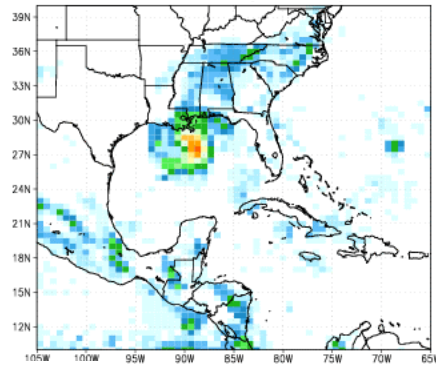
## Precipitation Rate

Precipitation Rate (mm/day) (Initialized: 2005 Aug 27, 12z)  
00Z29AUG2005

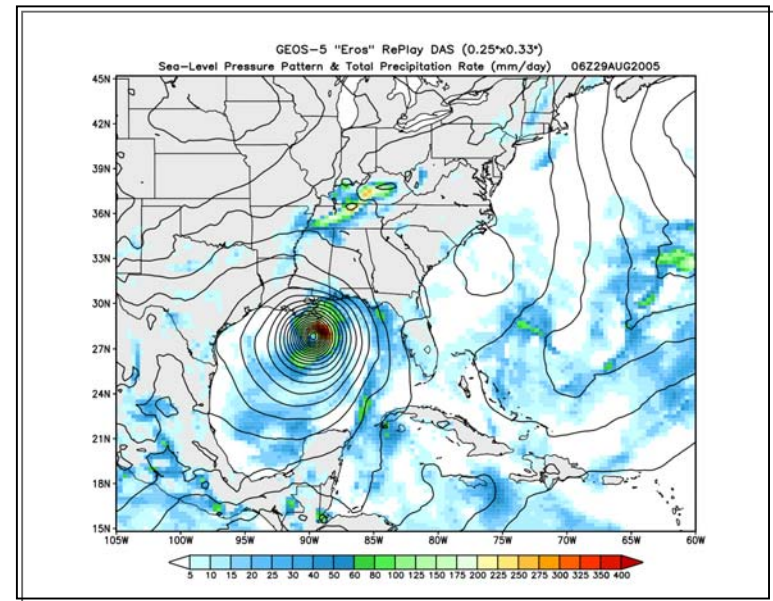
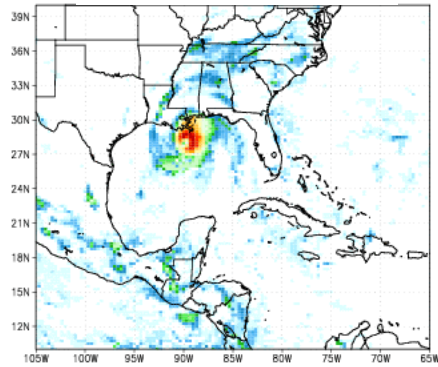
1 degree resolution



0.5 degree resolution



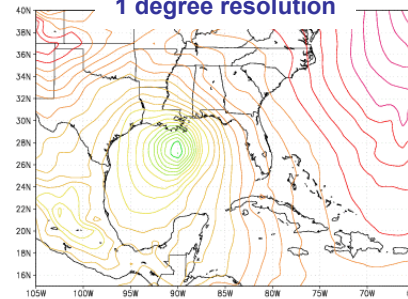
0.25 degree resolution



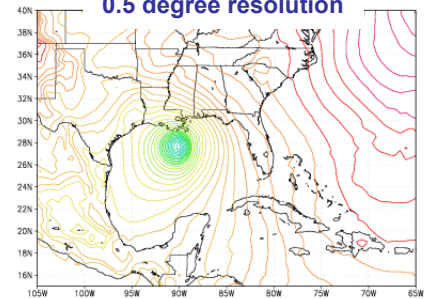
## Sea Level Pressure

Sea-Level Pressure (Initialized: 2005 Aug 27, 12z)  
00Z29AUG2005

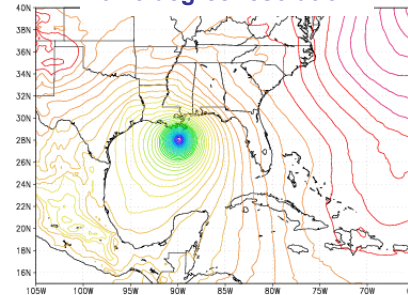
1 degree resolution



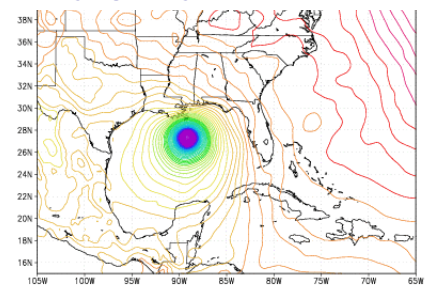
0.5 degree resolution



0.25 degree resolution



Verifying Analysis from NOAA/NCEP



# Concept of IAU

$$\frac{x}{\partial t} = \text{dynamics} + \text{physics} + \Delta x$$

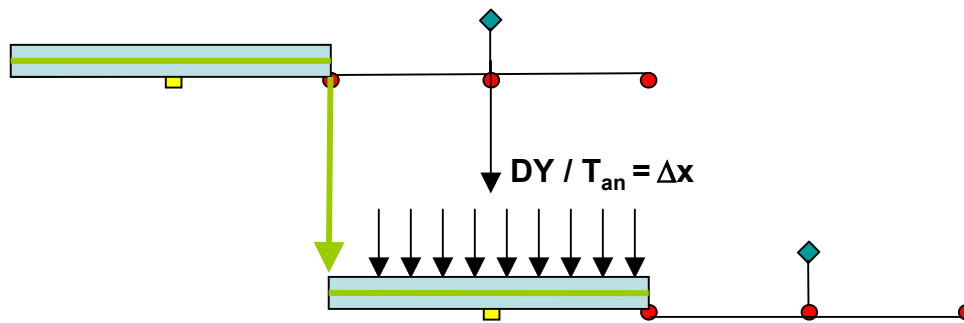
“Observed  
change”

Model predicted  
change

Correction from the  
DAS

0z    3z    6z    9z    12z    15z    18z    21z    0z    3z    6z    9z

←  $T_{an}$  →

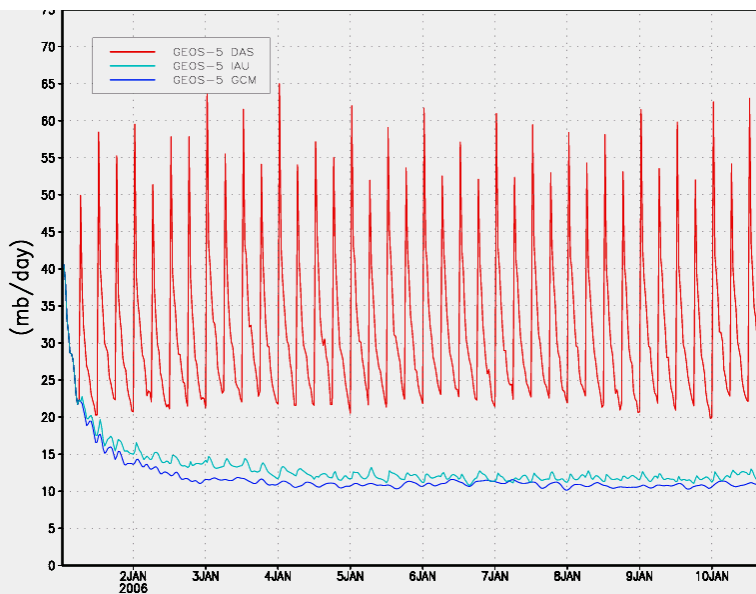


- ◆ Raw Analysis (from GSI)
- Assimilated analysis (application of IAU)
- Background (model forecast)

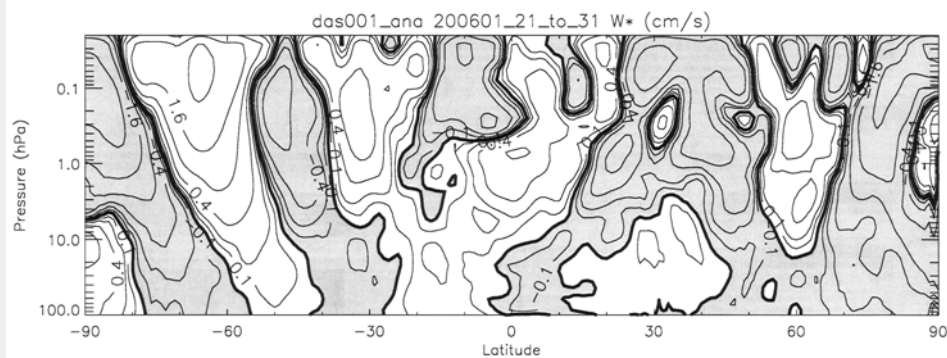
# Impacts of IAU

Residual Vertical Velocity

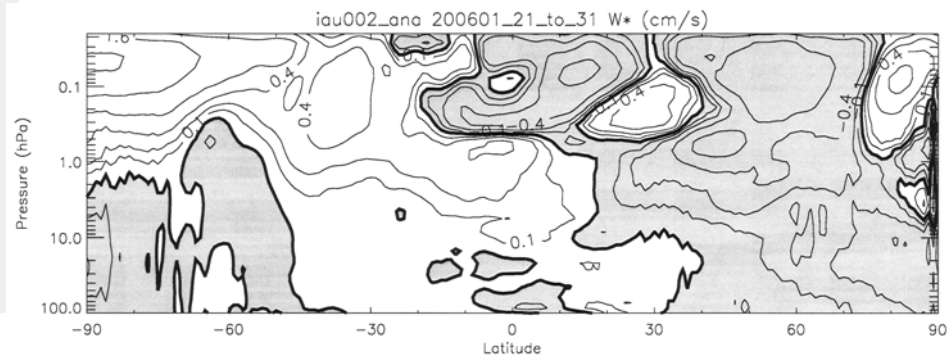
Globally Integrated RMS Surface Pressure Tendency



DAS w/o IAU



DAS with IAU





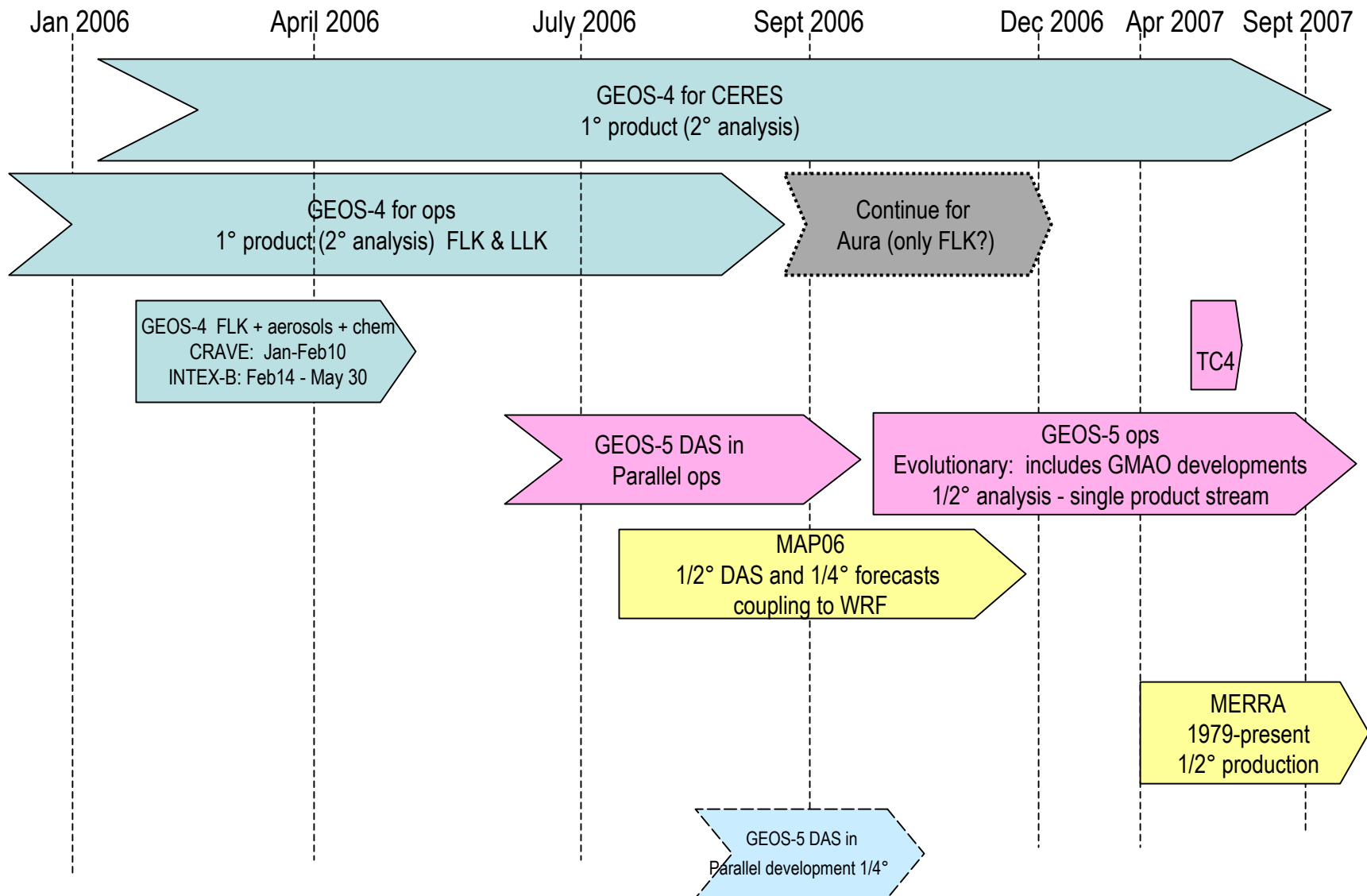
# Issues Being Addressed

- Moisture
  - physics tuning in DAS mode
    - Tropical land precipitation has to be reduced
    - Extra-tropical storm track precipitation has to be increased
  - online model bias correction through the DAS
  - retrospective bias correction through the model for MERRA
- Precipitation data
  - more effective weighting
  - consistent data (GPROF rain rate)
- SSU data - continuity between instruments (adaptive bias correction should help)
- Radiosonde data homogenization - still deciding on path
- QC for PSC contamination of AIRS channels
- Tuning balance constraint statistics
- Surface temperature product (important for CERES)
  - currently just from the model, analysis could be from replay mode

# Timeline for Operations

- August: finish current tuning
- Sept-Oct: validation for production system
- Nov: 2-degree spin-up sweep
- Dec/Jan: 1/2 degree MERRA validation runs + validation
- Feb/March: finalize; prepare for ops

# Timeline for Operations



# Summary of GEOS-5

- Developments:
  - Challenging, aggressive development
  - Major advances over GEOS-4
  - Aim for a documented, high-quality product
- Timeline:
  - Extensive validation in late 2006
  - Expect operational version in early 2007
  - High-quality data in late 2006